

## CLAIMS

1. A mixture of at least two amide-based compounds represented by General Formula (1):

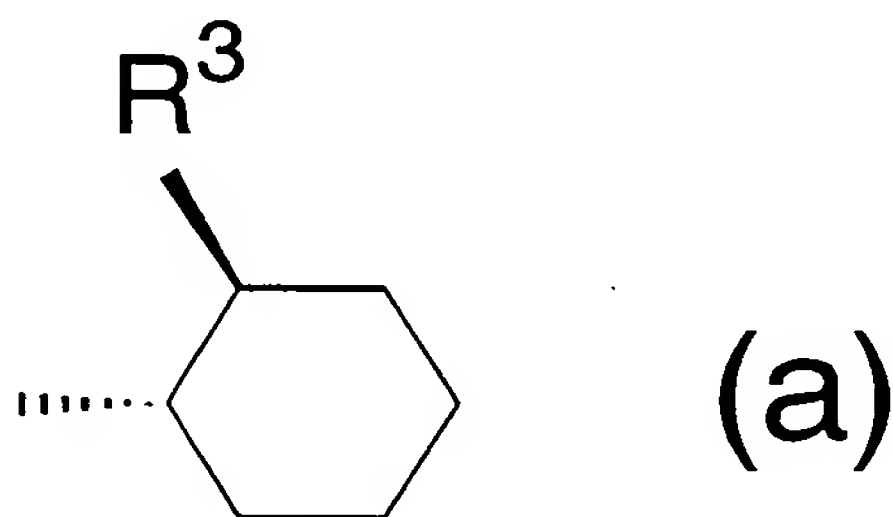


wherein

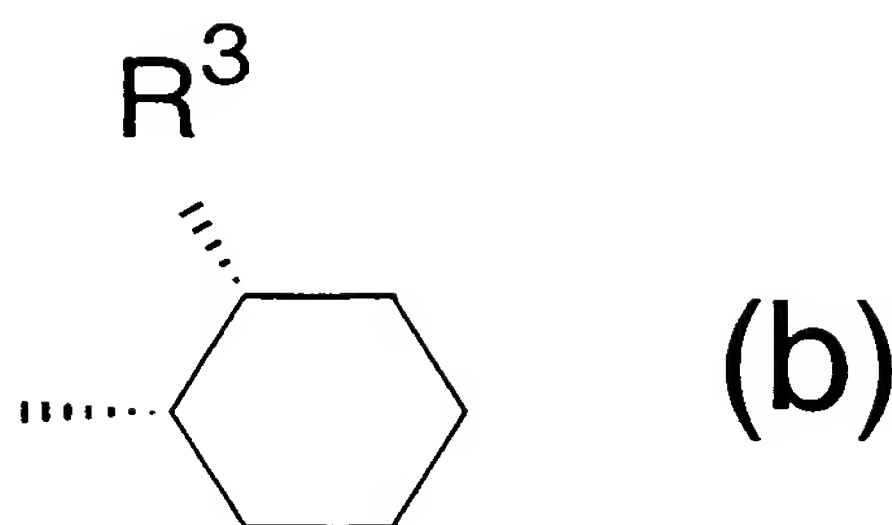
a represents an integer of 2 to 6,

10  $R^1$  represents a  $C_{2-30}$  saturated or unsaturated aliphatic polycarboxylic acid residue, and said aliphatic polycarboxylic acid residue has a valency of 2 to 6, and

the two to six  $R^2$  groups are the same or different, and each represent a trans-2-alkylcyclohexylamine residue  
15 represented by General Formula (a):



wherein  $R^3$  represents a  $C_{1-10}$  linear or branched alkyl group, or a cis-2-alkylcyclohexylamine residue represented by General Formula (b):



wherein  $R^3$  represents a  $C_{1-10}$  linear or branched alkyl group,  
 the trans-2-alkylcyclohexylamine residue represented by  
 General Formula (a) being present in a proportion of at least  
 5 70 mole % but less than 100 mole % of the total  
 2-alkylcyclohexylamine residues in the mixture.

2. A mixture according to Claim 1, wherein the  
 trans-2-alkylcyclohexylamine residue represented by General  
 10 Formula (a) is present in a proportion of at least 71.9 mole %  
 but less than 100 mole % of the total 2-alkylcyclohexylamine  
 residues in the mixture.

3. A mixture according to Claim 1, wherein  $R^3$  is a  $C_{1-6}$   
 15 linear or branched alkyl group.

4. A mixture according to Claim 1, wherein  $R^3$  is methyl.

5. A mixture according to Claim 1, wherein  $R^1$  is a  
 20 1,2,3-propanetricarboxylic acid residue or a  
 1,2,3,4-butanetetracarboxylic acid residue.

6. A mixture according to Claim 1, wherein  $R^1$  is a 1,2,3-propanetricarboxylic acid residue, and the mixture has a trans 2-alkylcyclohexylamine residue absorbance proportion (Ctrans) of at least 56.3% but less than 72.0% as defined by equation (E):

$$\text{Ctrans (\%)} = [\text{Atrans}/(\text{Atrans} + \text{Acis})] \times 100 \quad (\text{E})$$

wherein

Atrans represents the absorbance, as measured by FT-IR spectroscopy (Fourier Transform Infrared Spectroscopy), at a wavenumber at which the N-H stretching vibration absorption signal of the trans-2-alkylcyclohexylamine residue represented by General Formula (a) of the corresponding all-trans amide-based compound appears, and

Acis represents the absorbance, as measured by FT-IR spectroscopy (Fourier Transform Infrared Spectroscopy), at a wavenumber at which the N-H stretching vibration absorption signal of the cis-2-alkylcyclohexylamine residue represented by General Formula (b) of the corresponding all-cis amide-based compound appears.

7. A mixture according to Claim 1, wherein  $R^1$  is a 1,2,3,4-butanetetracarboxylic acid residue, and the mixture has a trans 2-alkylcyclohexylamine residue absorbance proportion (Ctrans) of at least 58.8% but less than 71.5% as

defined by equation (E):

$$C_{trans} (\%) = [A_{trans} / (A_{trans} + A_{cis})] \times 100 \quad (E)$$

wherein

5         $A_{trans}$  represents the absorbance, as measured by FT-IR spectroscopy (Fourier Transform Infrared Spectroscopy), at a wavenumber at which the N-H stretching vibration absorption signal of the trans-2-alkylcyclohexylamine residue represented by General Formula (a) of the corresponding all-trans amide-based compound appears, and

10         $A_{cis}$  represents the absorbance, as measured by FT-IR spectroscopy (Fourier Transform Infrared Spectroscopy), at a wavenumber at which the N-H stretching vibration absorption signal of the cis-2-alkylcyclohexylamine residue represented by General Formula (b) of the corresponding all-cis amide-based  
15        compound appears.

8. An amide-based compound represented by General Formula (1):



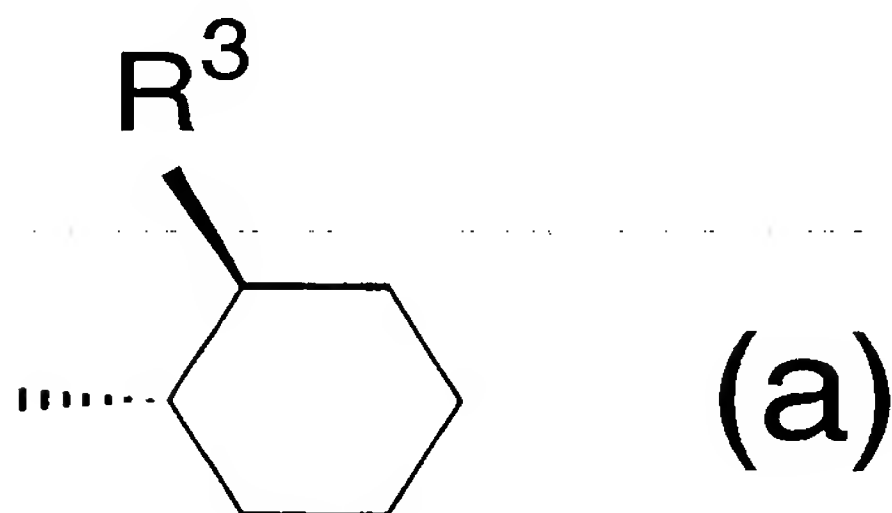
wherein

$a$  represents an integer of 2 to 6,

$R^1$  represents a  $C_{2-30}$  saturated or unsaturated aliphatic

polycarboxylic acid residue, and said aliphatic polycarboxylic acid residue has a valence of 2 to 6, and

the two to six  $R^2$  groups are the same, and represent a trans-2-alkylcyclohexylamine residue represented by General Formula (a):



wherein  $R^3$  represents a  $C_{1-10}$  linear or branched alkyl group.

9. An amide-based compound according to Claim 8, wherein  $R^3$  is a  $C_{1-6}$  linear or branched alkyl group.

10. An amide-based compound according to Claim 8, wherein  $R^3$  is methyl.

11. An amide-based compound according to Claim 8, wherein  $R^1$  is a 1,2,3-propanetricarboxylic acid residue or a 1,2,3,4-butanetetracarboxylic acid residue.

12. An amide-based compound according to Claim 8, wherein  $R^1$  is a 1,2,3,4-butanetetracarboxylic acid residue and  $R^3$  is methyl.

13. An amide-based compound according to Claim 8, wherein  $R^1$  is a 1,2,3-propanetricarboxylic acid residue and  $R^3$  is methyl.

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14. A polyolefin resin nucleating agent comprising the mixture according to any one of Claims 1 to 7.

15. A polyolefin resin nucleating agent comprising the  
10 amide-based compound according to any one of Claims 8 to 13.

16. A polyolefin resin composition comprising a polyolefin resin and a mixture according to any one of Claims 1 to 7 or an amide-based compound according to any one of Claims  
15 8 to 13.

17. A polyolefin resin composition according to Claim 16, wherein the composition contains 0.01 to 10 parts by weight of the mixture according to any one of Claims 1 to 7 or the  
20 amide-based compound according to any one of Claims 8 to 13, per 100 parts by weight of the polyolefin resin.

18. A polyolefin resin molded product obtainable by molding a polyolefin resin composition according to Claim 16.

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19. A process for producing a mixture of amide-based compounds represented by General Formula (1):



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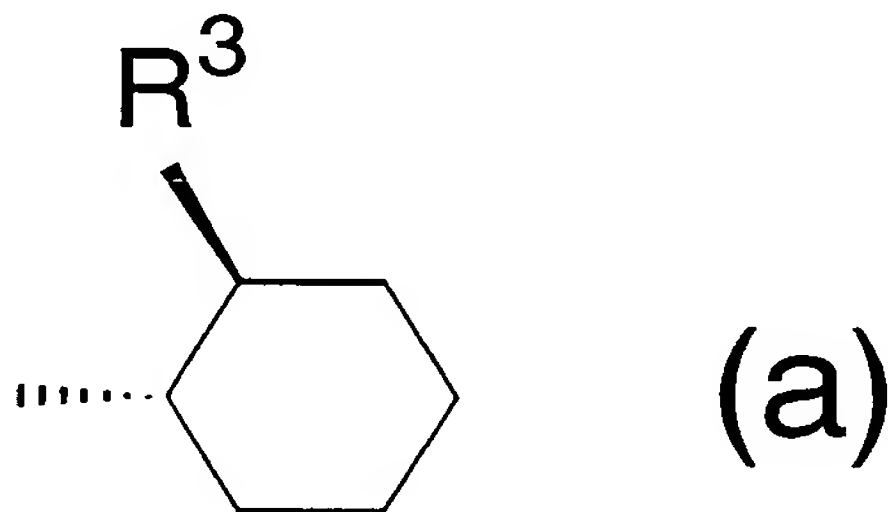
wherein

a represents an integer of 2 to 6,

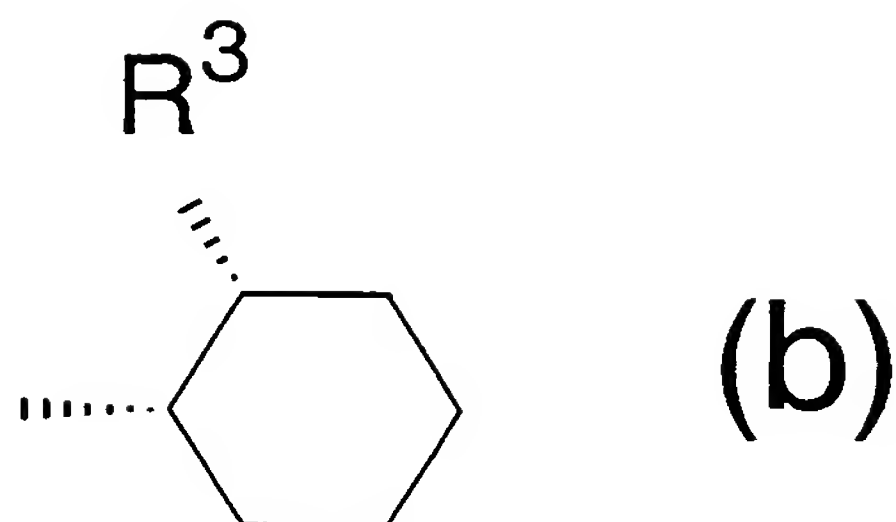
$R^1$  represents a  $C_{2-30}$  saturated or unsaturated aliphatic polycarboxylic acid residue, and said aliphatic polycarboxylic acid residue has a valency of 2 to 6, and

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the two to six  $R^2$  groups are the same or different, and each represent a trans-2-alkylcyclohexylamine residue represented by General Formula (a):

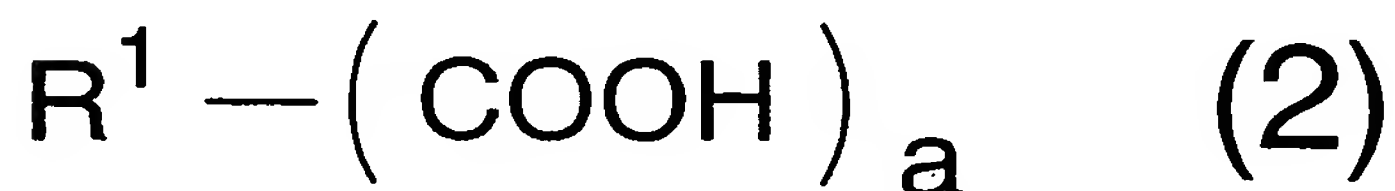


15 wherein  $R^3$  represents a  $C_{1-10}$  linear or branched alkyl group, or a cis-2-alkylcyclohexylamine residue represented by General Formula (b):

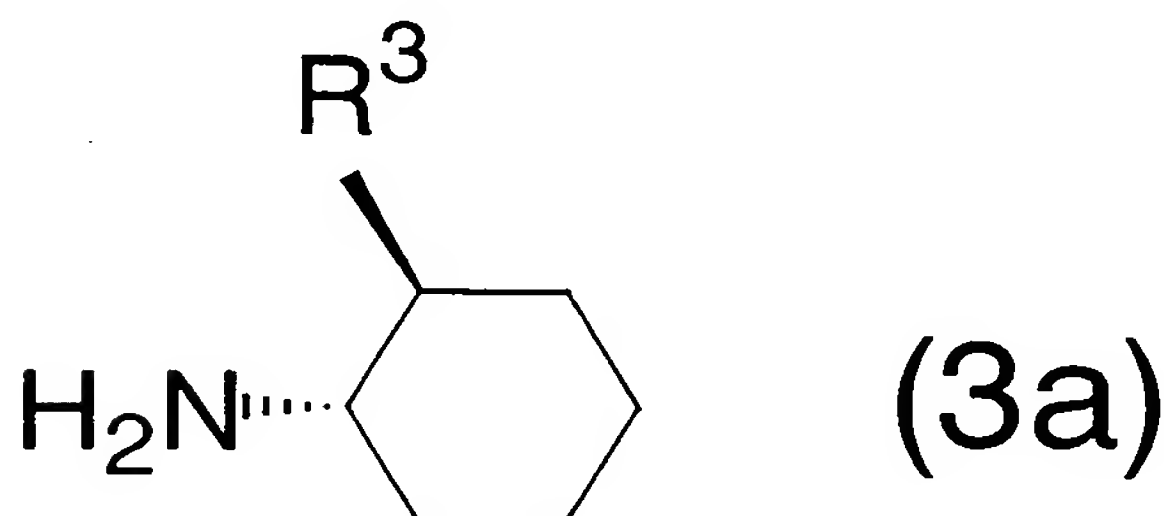


wherein  $R^3$  represents a  $C_{1-10}$  linear or branched alkyl group, the trans-2-alkylcyclohexylamine residue represented by General Formula (a) being present in a proportion of at least 70 mole % but less than 100 mole % of the total 2-alkylcyclohexylamine residues in the mixture,

the process comprising subjecting, to amidation reaction, a polycarboxylic acid represented by General Formula (2):

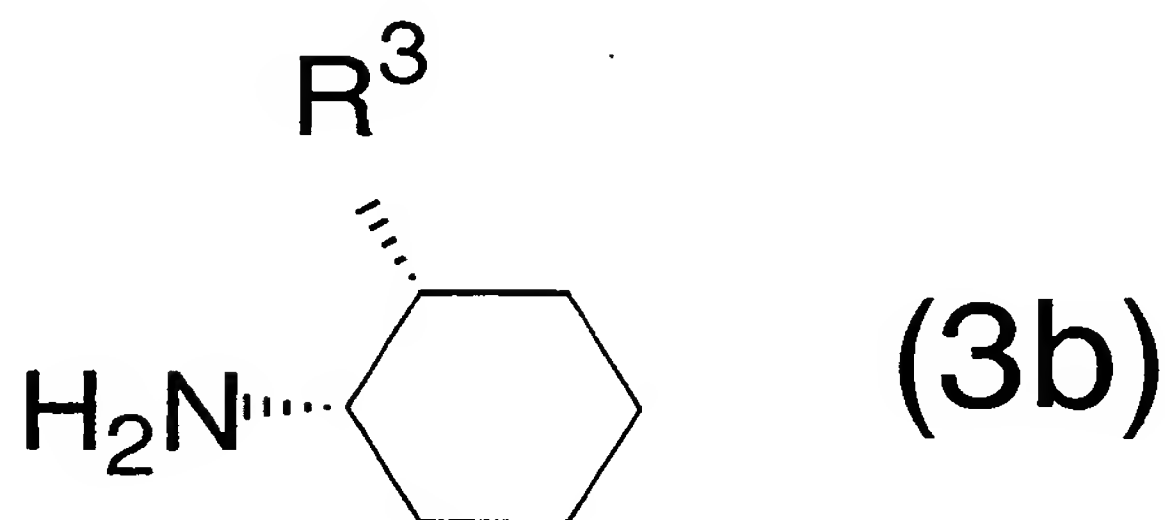


wherein  $R^1$  represents a  $C_{2-30}$  saturated or unsaturated aliphatic polycarboxylic acid residue, and  $a$  represents an integer of 2 to 6 or a reactive derivative thereof, and an amine mixture of (i) a trans-2-alkylcyclohexylamine represented by General Formula (3a):



wherein  $R^3$  represents a  $C_{1-10}$  linear or branched alkyl group,

and (ii) a cis-2-alkylcyclohexylamine represented by General Formula (3b)



wherein  $\text{R}^3$  represents a  $\text{C}_{1-10}$  linear or branched alkyl group, the content of the trans-2-alkylcyclohexylamine in the amine mixture being at least 70% but less than 100% as determined by gas chromatography (GLC).

20. A process for producing an amide-based compound represented by General Formula (1):



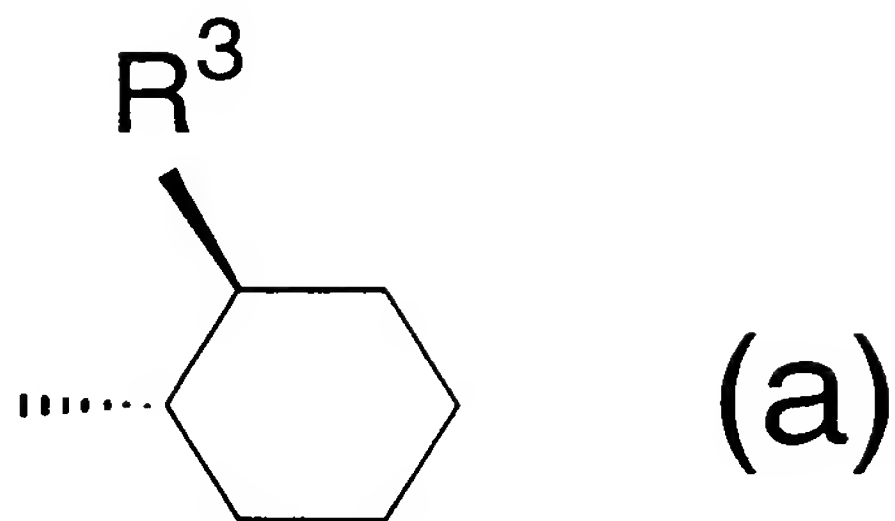
wherein

a represents an integer of 2 to 6,

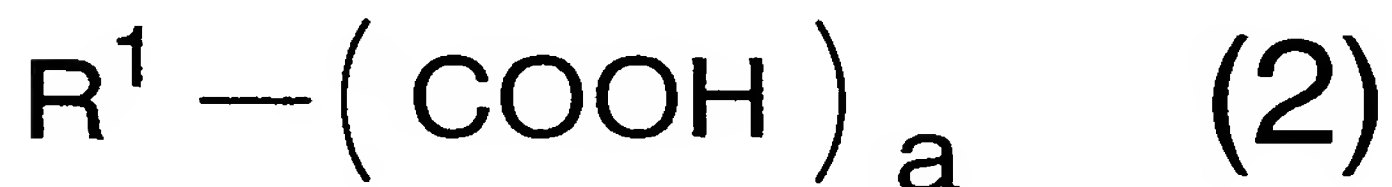
$\text{R}^1$  represents a  $\text{C}_{2-30}$  saturated or unsaturated aliphatic polycarboxylic acid residue, and said aliphatic polycarboxylic acid residue has a valency of 2 to 6, and

the two to six  $\text{R}^2$  groups are the same and represent a trans-2-alkylcyclohexylamine residue represented by General

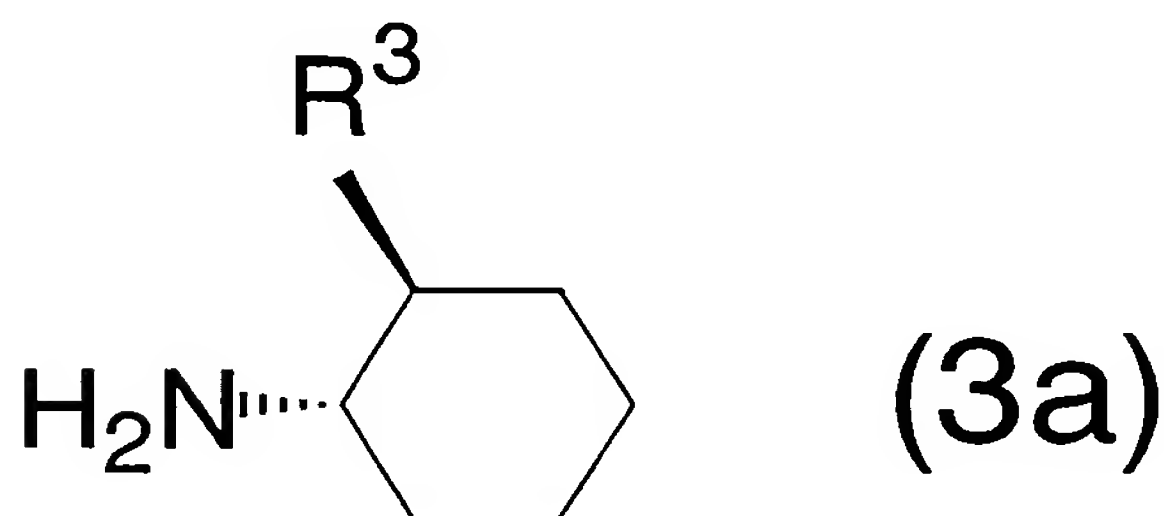
Formula (a) :



wherein  $R^3$  represents a  $C_{1-10}$  linear or branched alkyl group,  
the process comprising subjecting, to amidation reaction,  
5 a polycarboxylic acid represented by General Formula (2) :



wherein  $R^1$  represents a  $C_{2-30}$  saturated or unsaturated aliphatic  
polycarboxylic acid residue, and  $a$  represents an integer of  
2 to 6 or a reactive derivative thereof, and  $a$   
10 trans-2-alkylcyclohexylamine represented by General Formula  
(3a) :



wherein  $R^3$  represents a  $C_{1-10}$  linear or branched alkyl group.

15            21. A method for improving rigidity of a polyolefin  
resin molded product, the method comprising incorporating a

mixture according to any one of Claims 1 to 7 or an amide-based compound according to any one of Claims 8 to 13 into a polyolefin resin to obtain a polyolefin resin composition, and molding the polyolefin resin composition.

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22. Use of a mixture according to any one of Claims 1 to 7 or an amide-based compound according to any one of Claims 8 to 13 for improving rigidity of a polyolefin resin molded product.

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